Claims

1. A switching power supply circuit which includes a rectification section for rectifying an AC input voltage and a smoothing section for smoothing the rectification voltage from said rectification section, and a first switching converter section and a second switching converter section for receiving and operating with the smoothed voltage from said smoothing section as a DC input voltage, said first and second switching converter sections being activated at different timings from each other when to be activated, wherein

each of the plurality of switching converter sections includes:

a switching section for receiving the DC input voltage to perform switching operation, said switching section being formed from a high side switching element and a low side switching element connected in a half-bridge connection;

a switching driving section for switching driving the switching elements;

an insulating converter transformer formed by winding at least a primary winding to which a switching output obtained by the switching operation of said switching section is supplied and a secondary winding in

which an alternating voltage as a switching output obtained in said primary winding is excited;

a primary side series resonance circuit formed at least from a leakage inductance component of said primary winding of said insulating converter transformer and a capacitance of a primary side series resonance capacitor connected in series to said primary winding for making operation of said switching section that of a current resonance type;

a primary side partial voltage resonance circuit formed from a capacitance of a partial voltage resonance capacitor connected in parallel to one of the two switching elements each of which forms the half bridge connection and a leakage inductance component of said primary winding of said insulating converter transformer, voltage resonance operation of said primary side partial voltage resonance circuit being obtained only in response to each of timings at which each of said switching elements turns on and turns off;

a DC output voltage production section for receiving a secondary side AC voltage obtained by said secondary winding of said insulating converter transformer and performing rectification operation of the received secondary side AC voltage to produce a plurality

of secondary side DC output voltages;

a frequency control type fixed voltage control section for controlling said switching driving section in response to a level of a required one of the plurality of secondary side DC output voltages to vary the switching frequency of said switching section to perform fixed voltage control for the required one of the secondary side DC output voltages;

an inductance control type fixed voltage control section provided for each of required ones of the secondary side DC output voltages which are required to be fixed voltages other than the required one of the secondary side DC output voltages which is an object of the fixed voltage control by said frequency control type fixed voltage control section, said inductance control type fixed voltage control section being configured such that a controlled winding of a control transformer in the form of a saturable reactor having a control winding and said controlled winding wound thereon is inserted in a secondary side rectification current path for producing the secondary side DC output voltage and a control current level to be supplied to said control winding is varied in response to the inputted secondary side DC output voltage level to vary the inductance of the

controlled winding thereby to perform fixed voltage control for the secondary side DC output voltage; and

a power factor improving circuit including a power factor improving transformer formed by winding a power factor improving primary winding inserted in series in said primary side series resonance circuit and a power factor improving secondary winding inserted in a rectification current path formed as said rectification smoothing section and a rectification element inserted in a required location of said rectification current path for performing switching operation based on an excited voltage excited in said power factor improving secondary winding by said power factor improving primary winding to interrupt the rectification current for improving the power factor;

said first switching converter section including a first switch section for operating, at a timing after predetermined time elapses after a predetermined secondary side DC output voltage rises, to change over a secondary side rectification current path for producing another predetermined secondary side DC output voltage from an off state to an on state.

2. A switching power supply circuit according to claim 1, wherein said first switch section changes over

the secondary side rectification current path from an off state to an on state in response to an activation control signal inputted at the timing after the lapse of the predetermined time.

3. A switching power supply circuit according to claim 1, wherein:

said rectification section is diodes connected in a bridge connection and has two terminals to which the AC input voltage is supplied, a reference potential terminal connected to a reference potential and a rectification voltage output terminal from which a rectification voltage is outputted;

said smoothing section is two smoothing capacitors connected in series between said rectification voltage output terminal and said reference potential terminal through a node therebetween; and

said switching power supply circuit further comprises a second switch section provided between one of the two terminals to which the AC input voltage is supplied and said node for performing changeover such that, when the AC input voltage is lower than a reference voltage, a voltage doubler rectification operation wherein said second switch section is placed into an on state to produce a rectification smoothed voltage of a

level equal to twice the AC input voltage level is performed, but when the AC input voltage is higher than the reference voltage, an equal voltage rectification operation wherein said second switch section is placed into an off state to produce the rectification smoothed voltage of another level equal to the AC input voltage level is performed.

4. A first switching power supply circuit and another switching power supply circuit which include a rectification section for rectifying an AC input voltage and a smoothing section for smoothing the rectification voltage from said rectification section, and a plurality of switching converter sections for receiving and operating with the smoothed voltage from said smoothing section as a DC input voltage, one of said plurality of switching converter sections being activated at a timing determined in advance, wherein

each of the plurality of switching converter sections includes:

a switching section for receiving the DC input voltage to perform switching operation, said switching section being formed from a high side switching element and a low side switching element connected in a half-bridge connection;

a switching driving section for switching driving the switching elements;

an insulating converter transformer formed by winding at least a primary winding to which a switching output obtained by the switching operation of said switching section is supplied and a secondary winding in which an alternating voltage as a switching output obtained in said primary winding is excited;

a primary side series resonance circuit formed at least from a leakage inductance component of said primary winding of said insulating converter transformer and a capacitance of a primary side series resonance capacitor connected in series to said primary winding for making operation of said switching section that of a current resonance type;

a primary side partial voltage resonance circuit formed from a capacitance of a partial voltage resonance capacitor connected in parallel to one of the two switching elements each of which forms the half bridge connection and a leakage inductance component of said primary winding of said insulating converter transformer, voltage resonance operation of said primary side partial voltage resonance circuit being obtained only in response to each of timings at which each of said switching

elements turns on and turns off;

a DC output voltage production section for receiving a secondary side AC voltage obtained by said secondary winding of said insulating converter transformer and performing rectification operation of the received secondary side AC voltage to produce a plurality of secondary side DC output voltages;

a frequency control type fixed voltage control section for controlling said switching driving section in response to a level of a required one of the plurality of secondary side DC output voltages to vary the switching frequency of said switching section to perform fixed voltage control for the required one of the secondary side DC output voltages;

an inductance control type fixed voltage control section provided for each of required ones of the secondary side DC output voltages which are required to be fixed voltages other than the required one of the secondary side DC output voltages which is an object of the fixed voltage control by said frequency control type fixed voltage control section, said inductance control type fixed voltage control section being configured such that a controlled winding of a control transformer in the form of a saturable reactor having a control winding and

said controlled winding wound thereon is inserted in a secondary side rectification current path for producing the secondary side DC output voltage and a control current level to be supplied to said control winding is varied in response to the inputted secondary side DC output voltage level to vary the inductance of the controlled winding thereby to perform fixed voltage control for the secondary side DC output voltage; and

a first switch section for changing over the secondary side rectification current path for producing another predetermined secondary side DC output voltage from an off state to an on state at the timing after lapse of a predetermined time after a predetermined secondary side DC output voltage rises; and

a power factor improving circuit for improving the power factor;

said power factor improving circuit including a power factor improving transformer formed by winding a power factor improving primary winding inserted in series in said primary side series resonance circuit and a power factor improving secondary winding inserted in a rectification current path formed as said rectification smoothing section and

a rectification element inserted in a required

location of the rectification current path for performing switching operation based on an excited voltage excited in said power factor improving secondary winding by said power factor improving primary winding to interrupt the rectification current.

5. A switching power supply circuit according to claim 1, wherein

each of said first switch section provided in said first switching converter section and said first switch section provided in the other switching converter section

receives a predetermined one of the plurality of secondary side DC output voltages produced by said DC output voltage production section of said first switching converter section and changes over the secondary side rectification current path from an off state to an on state after a delay of time obtained by a time constant circuit after a point of time at which the secondary side DC output voltage being received rises.

6. A switching power supply circuit according to claim 1, wherein

said rectification section is diodes connected in a bridge connection and has two terminals to which the AC input voltage is supplied, a reference potential terminal connected to a reference potential and a rectification

voltage output terminal from which a rectification voltage is outputted;

said smoothing section is two smoothing capacitors connected in series between said rectification voltage output terminal and said reference potential terminal through a node therebetween; and

said switching power supply circuit further comprises a second switch section provided between one of the two terminals to which the AC input voltage is supplied and said node for performing changeover such that, when the AC input voltage is lower than a reference voltage, a voltage doubler rectification operation wherein said second switch section is placed into an on state to produce a rectification smoothed voltage of a level equal to twice the AC input voltage level is performed, but when the AC input voltage is higher than the reference voltage, an equal voltage rectification operation wherein said second switch section is placed into an off state to produce the rectification smoothed voltage of another level equal to the AC input voltage level is performed.

7. A plasma display apparatus, comprising a switching power supply circuit according to claim 1 or 4, the secondary side DC output voltage being supplied as a

driving power supply to said plasma display apparatus.